PATENT ABSTRACTS OF JAPAN

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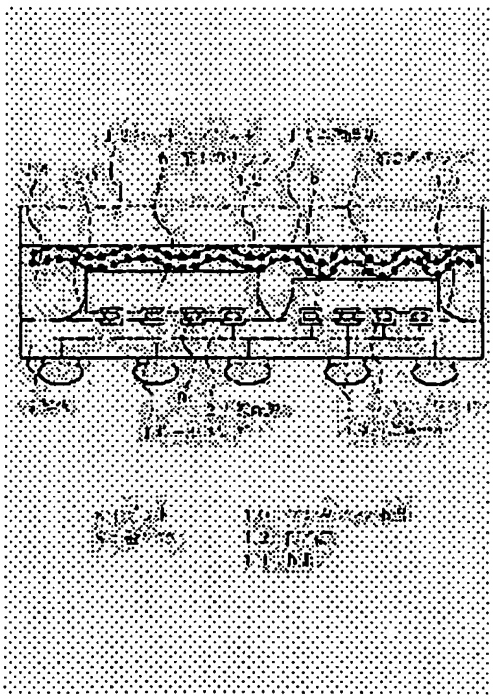
(54) SEMICONDUCTOR DEVICE AND ITS MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent deterioration of a heat-conducting characteristic at the time of resin sealing by a method wherein heat dissipating efficiency is increased and made uniform also for chips different in size and height.

SOLUTION: A plurality of semiconductor chips 6, 7 are mounted on a substrate 1, a heat spreader 13 is mounted via an intermediate bent 11 composed of a metal material on a resin surface opposite to a surface on which pads 8 of the chips are formed, and a package is formed by filling them with a resin 14. The intermediate bent 11 is formed so as to be freely bent in order to align height of parts between the chips 6, 7 and the heat spreader 13, and has protrusions and uneven parts 12 on its upper and lower surfaces in order to make multipoint contact possible.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
Especially this invention relates to the semiconductor package and its manufacture approach of the flip chip (FC) mold ball grid array (BGA) type which carried many semiconductor chips with which size differs from height about a semiconductor device and its manufacture approach, and equipped the outside with the heat spreader (heat sink).
[0002]
[Description of the Prior Art]
The field in which the pad of the chip was formed has [the semiconductor package of the FC mold BGA type which the former requires, i.e., the FC mold BGA type semiconductor package which carried two or more kinds of semiconductor chips in the substrate,] the common structure of laying a heat sink in the resin side of the opposite side.
[0003]
However, since the heat sink is prepared in many cases, without usually taking the size and the height of a chip into consideration, it produces a clearance by height dispersion of a chip, or height dispersion of junction of a substrate and a chip, and is difficult to join a chip to a heat sink to homogeneity. moreover, if it is going to arrange height by force, in order for a chip to thickness-see, to arrange and to arrange in ** chip loading height, production time is required and there is a problem which says that a manufacturing cost becomes high.
[0004]
In order to solve such a problem, in the conventional package, various kinds of devices for heat dissipation are adopted, and the concrete conventional example of 2-3 is explained with reference to a drawing below.
[0005]
Drawing 6 is the sectional view of a semiconductor package showing a conventional example [patent reference 1 reference]. As shown in drawing 6 , on a printed circuit board 20, by the flip-chip-bonding section 23, such a conventional semiconductor package carried the semiconductor device 21, and arranges the heat sink 26 through flat spring 25 in the upper part of the semiconductor device 21. The solder ball 22 performs electrical installation of a semiconductor device 21 and a printed circuit board 21.
[0006]
Since this flat spring 25 is a straight-line configuration, when contact to a semiconductor device 21 is the minimum, only one place may contact, therefore its heat dissipation effectiveness is small, and dispersion produces it. Moreover, between a heat sink 26, a printed circuit board 20, and a semiconductor device 21, when it is going to perform resin enclosure, resin enters the clearance between flat spring 25 and a semiconductor device 21, and sufficient contact is no longer acquired.
[0007]

Drawing 7 is the sectional view of a semiconductor package showing other conventional examples [patent reference 2 reference]. As shown in drawing 7 , the semiconductor package which the former requires is structure fixed to a heat sink 26 through the junction substrate which arranges the metal thin line group 31 at the rear face of a semiconductor chip 21, and consists of a copper plate 28, a ceramic plate 29, and a copper plate 30. A metal thin line in the air constructs two or more sets of this metal thin line group 31, and it is formed.

[0008]

In the approach of using the metal thin line group 31 for this semiconductor package, although the contact to a semiconductor chip 21 and a heat sink 26 succeeds, its possibility of a thin line ****(ing), becoming metal waste and moreover causing the poor electric short circuit of other parts during manufacture is high. Moreover, when resin tends to enclose this semiconductor package, it is difficult in each thin line to pour resin into homogeneity.

[0009]

Drawing 8 is the sectional view of a semiconductor package showing another conventional example again [patent reference 3 reference]. As shown in drawing 8 R> 8, this conventional kind of semiconductor package 35 The circuit board 34 connected to the lead 36 of both sides through a tab 37, and the semiconductor device 32 carried in the circuit board 34 through a bump 33, It has the cap 38 put on a package 35, and the heat-conducting characteristic metal foil 40 processed into solder 41A and 41B and a flexible configuration in the semiconductor device 32, and the heat sink 39 for heat dissipation is attached on cap 38, and it is constituted. This heat-conducting characteristic metal foil 40 is formed in order to make it easy to radiate heat in the heat which a semiconductor device 32 generates, it processes the thin metal plate of high temperature conductivity into a wave type configuration, and connects that Yamabe and trough to a semiconductor device 32 and cap 38 through solder 41A and 41B, respectively. According to such structure, the heat generated in the semiconductor device 32 is transmitted to cap 38 and a heat sink 39 through the heat-conducting characteristic metal foil 40. In addition, cap 38 is omitted and this semiconductor package 35 can also use a heat sink 39 instead of a cap.

[0010]

Also in this semiconductor package, like the example of drawing 6 mentioned above, since there is no irregularity, when contact to a semiconductor device (chip) 32 is the minimum, it is possible [it / the heat-conducting characteristic metal foil 40 is a flat spring configuration, and] that only one place contacts. Therefore, dispersion arises the top where the heat dissipation effectiveness is small. In addition, in this example, although it is not resin enclosure, when it is going to perform resin enclosure, resin enters and a possibility of stopping contacting also has it in the clearance between flat spring and a chip.

[0011]

[Patent reference 1]

JP,11-68360,A (4th page - 5 pages, drawing 1)

[Patent reference 2]

JP,2000-223631,A (the 3rd page, drawing 1)

[Patent reference 3]

JP,7-142647,A (the 3rd page, drawing 1)

[0012]

[Problem(s) to be Solved by the Invention]

In a technique like the patent reference 1, the conventional semiconductor device mentioned above and its manufacture approach have the small heat dissipation effectiveness, and moreover, an uneven top, when performing resin enclosure, resin enters between flat spring and a chip and they have the fault of severing the contact for heat conduction.

[0013]

Moreover, in a technique like the patent reference 2, in case a thin line serves as metal waste, produces the electric short circuit of bonding wiring or other wiring and it not only raises a poor product, but it carries out resin enclosure, there is a fault that resin cannot be poured into homogeneity into a thin line

in the middle of manufacture.
[0014]
Furthermore, in a technique like the patent reference 3, since there is no irregularity in flat spring, when contact to the top face of a chip and flat spring is the minimum, only one place contacts, but there is a fault that the heat dissipation effectiveness produces dispersion small. Moreover, in this case, when performing resin enclosure, resin enters the clearance between flat spring and a chip, and there is also a fault of it becoming impossible to take both contact.
[0015]
The purpose of this invention is to solve the problem mentioned above, and even when resin enclosure is performed, it offers the semiconductor device which can prevent degradation of heat-conducting characteristic, and its manufacture approach, while enabling it to take the fully large heat dissipation effectiveness to homogeneity.
[0016]
[Means for Solving the Problem]
The substrate with which the semiconductor device of this invention formed internal wiring, and two or more semiconductor chips carried on said substrate, While being arranged according to the height of a clearance between the field where the heat spreader for radiating outside the heat which emits from said two or more semiconductor chips and the loading side of two or more of said semiconductor chips are opposite, and the inferior surface of tongue of said heat spreader It has resin which closes the middle curved plate which formed two or more projections up and down, said substrate, said two or more semiconductor chips and said middle curved plate, and said heat spreader, and is constituted.
[0017]
Said middle curved plate in this semiconductor device consists of thin metal material, and said two or more projections of said middle curved plate can transform or process said middle curved plate, and can form concave heights.
[0018]
Said middle curved plate in this semiconductor device can be formed using the metal ring of the shape of a cylindrical shape which formed two or more projections up and down.
[0019]
The part of said heat spreader corresponding to the location of two or more of said semiconductor chips can be used for said said middle curved plate in this semiconductor device as flat spring, and it can form two or more projections in that inferior surface of tongue.
[0020]
Said said middle curved plate in this semiconductor device can be formed using right thermal-conductivity adhesives.
[0021]
Moreover, the process which the manufacture approach of the semiconductor device of this invention makes join two or more semiconductor chips to the substrate bottom, and pours undershirt philharmonic resin into a part for the joint, The process which carries the middle curved plate and the heat spreader in which two or more projections were formed, on said semiconductor chip as abolishes height dispersion, and maintains the parallelism of said substrate and said heat spreader, It is constituted including said substrate, the process which pours resin into the clearance between said heat spreaders, and the process which joins a solder ball to the ball bump who forms in the principal plane of said substrate, with the parallelism of said substrate carrying said semiconductor chip, and said heat spreader maintained.
[0022]
[Embodiment of the Invention]
Next, the gestalt of operation of this invention is explained with reference to a drawing.
[0023]
Drawing 1 is the sectional view of the package in which the gestalt of operation of the 1st of the semiconductor device of this invention is shown. As shown in drawing 1 , the semiconductor package in the gestalt of this operation Since the bump land 3 and the ball bump 4 who form the internal wiring 2

and are connected to that internal wiring 2 are carried on the insulating substrate 1 formed in one field and the field of another side, and this insulating substrate 1 While flip junction loading is carried out by golden BAPU 9, between the bump lands 3 of the pad 8 prepared in one principal plane, and the insulating substrate 1 The 1st chip 6 and 2nd chip 7 by which the closure is carried out with under-filling resin 10 in the connected part, The heat spreader 13 which consists of metal material for emitting the heat emitted from these 1st chips 6 and the 2nd chip 7 to the equipment exterior, The middle curved plate 11 which consists of metal material, such as thermally conductive thin high (good conductance) copper which has been arranged between a field opposite to one principal plane of these 1st chips 6 and the 2nd chip 7, and the inferior surface of tongue of the heat spreader 13, and formed two or more concave heights 12, It has resin 14 for joining the insulating substrate 1, the 1st chip 6, the 2nd chip 7, the middle curved plate 11, and the heat spreader 13. In case this semiconductor package is mounted in the printed circuit board etc., the solder ball 5 is put on the ball bump 4 of a substrate 1, and it connects with the pad section of the printed circuit board. In addition, the golden bump 9 may use a solder ball.

[0024]

The middle curved plate 11 in this semiconductor package forms many concave heights 12 in those upper and lower sides while making metal material, such as copper, thin, in order to make bending free. In fact, these concave heights 12 can make able to transform it and form the middle curved plate 11, or can perform and form processing etc. Moreover, the thickness of the middle curved plate 11 is 30 micrometers to about 100 micrometers in general, and the height of the concave heights 12 is 50 micrometers or less in general. The middle curved plate 11 is a plate of thin meat, and since it has loose curvature, these concave heights 12 can be made to deform by the weak pressure.

[0025]

Moreover, like illustration, size may differ from height and two or more packages 6 and 7 are good also in the same size and the same height.

[0026]

Drawing 2 (a) - (d) is the sectional view of the package shown in order of the process for explaining the gestalt of 1 implementation of the manufacture approach of the semiconductor device of this invention, respectively. First, as shown in drawing 2 (a), the bump land 3 and the ball bump 4 linked to the internal wiring 2 are put on the insulating substrate 1 in which the internal wiring 2 was formed, to both sides of a substrate 1.

[0027]

Subsequently, as shown in drawing 2 (b), heat, supersonic vibration, and a pressure are applied to the bump land 3 of a substrate 1 top, and the chips 6 and 7 which followed the golden bump 9 are joined to it. Then, in order to protect from penetration of moisture, dust, etc. to a part for a joint, undershirt philharmonic resin 10 is poured in between chips 6 and 7 and a substrate 1, and the joint circumference is closed.

[0028]

Subsequently, as shown in drawing 2 (c), on a chip 6 and 7, as height dispersion is abolished, the middle curved plate 11 and the heat spreader 13 are carried, and the parallelism of a substrate 1 and the heat spreader 13 is maintained. Since it is sheet metal made from copper and thickness is 30 micrometers to about 100 micrometers in general as mentioned above, the middle curved plate 11 can be made to deform free, and moreover, since the height of the concave heights 12 is 50 micrometers or less in general, it can be made to deform by the weak pressure here.

[0029]

Furthermore, resin 14 is poured into the clearance between a substrate 1 and the heat spreader 13, maintaining the parallelism of the substrate 1 carrying chips 6 and 7, and the heat spreader 13, as shown in drawing 2 (d). Chips 6 and 7, a substrate 1, the middle curved plate 11, and the heat spreader 13 are joined by the junction force of this resin 14. Finally, the solder ball 5 is joined to the ball bump 4 who forms in the principal plane of a substrate 1.

[0030]

While forming many projections 12 between two or more chips 6 and 7 and the heat spreaders 13 with

which height differs from size according to the gestalt of this operation mentioned above Since the difference of two or more chips 6 and 7 with which height differs by making the thin middle curved plate 11 which consists of a good conductive metal intervene, and carrying is absorbable Since it can tell homogeneity to the heat spreader 13 and much projections 12 can moreover be contacted for chips 6 and 7, without spoiling the heat dissipation from two or more chips 6 and seven both sides Also when enclosing resin 14, it can also be prevented that resin 14 enters a clearance and degrades heat-conducting characteristic.

[0031]

Drawing 3 is the sectional view of the package in which the gestalt of operation of the 2nd of the semiconductor device of this invention is shown. As shown in drawing 3 , the semiconductor package in the gestalt of this operation carries the top face (rear face) of chips 6 and 7, and the cylindrical metal ring 15 of the thin meat in which two or more projections 16 were formed between the heat spreaders 13. This metal ring 15 deforms according to the clearance between chips 6 and 7 and the heat spreader 13 using right thermal metals, such as copper. In addition, about other members, it is the same as that of the gestalt of operation of the 1st of drawing 1 mentioned above.

[0032]

Drawing 4 is the sectional view of the package in which the gestalt of operation of the 3rd of the semiconductor device of this invention is shown. As shown in drawing 4 , the semiconductor package in the gestalt of this operation forms a notch and flat spring 17 for the part applicable to the location of the chips 6 and 7 of the heat spreader 13. And two or more projections 16 are formed in the inferior surface of tongue of the flat spring 17, and it is pressed down at the chip rear face. About the difference in the height of these chips 6 and 7 and the heat spreader 13, the difference is absorbed by changing the stiffness of a flat spring 17. Moreover, about other members, it is the same as that of drawing 3 mentioned above.

[0033]

Drawing 5 is the sectional view of the package in which the gestalt of operation of the 4th of the semiconductor device of this invention is shown. As shown in drawing 5 , the semiconductor package in the gestalt of this operation is replaced with the metal ring and flat spring in the gestalt of the 2nd and the 3rd operation mentioned above, and the good conductance adhesives 18 are used for it. These adhesives 18 of right thermal conductivity carry the heat spreader 13 by applying for example, a silver paste and changing that thickness about the difference in height. Moreover, about other members, it is the same as that of drawing 3 mentioned above.

[0034]

Furthermore, about the manufacture approach of the semiconductor device in the gestalt of these operations, it can carry out like the procedure of drawing 2 mentioned above.

[0035]

[Effect of the Invention]

Moreover, the effectiveness that it can tell to a heat spreader is in homogeneity, without spoiling two or more heat dissipation from both chip, since the difference of two or more chips with which height differs by making the middle curved plate which the semiconductor device and its manufacture approach of this invention form a projection between two or more chips and a heat spreader as explained above, and consists of a good conductive metal intervene, and carrying is absorbable.

[0036]

Moreover, since much projections can be contacted for a chip by preparing many projections in a middle curved plate, this invention is effective in the ability of resin entering a clearance and degrading heat-conducting characteristic to also be prevented, also when performing resin enclosure.

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the package in which the gestalt of operation of the 1st of the semiconductor device of this invention is shown.

[Drawing 2] It is the sectional view of the package shown in order of the process for explaining the gestalt of 1 implementation of the manufacture approach of the semiconductor device of this invention.

[Drawing 3] It is the sectional view of the package in which the gestalt of operation of the 2nd of the semiconductor device of this invention is shown.
[Drawing 4] It is the sectional view of the package in which the gestalt of operation of the 3rd of the semiconductor device of this invention is shown.
[Drawing 5] It is the sectional view of the package in which the gestalt of operation of the 4th of the semiconductor device of this invention is shown.
[Drawing 6] It is the sectional view of a semiconductor package showing a conventional example.
[Drawing 7] It is the sectional view of a semiconductor package showing other conventional examples.
[Drawing 8] It is the sectional view of a semiconductor package showing another conventional example again.
[Description of Notations]
1 Substrate
2 Internal Wiring
3 Bump Land
4 Ball Bump
5 Solder Ball
6 Seven Semiconductor chip
8 Pad
9 Golden Bump
10 Undershirt Philharmonic Resin
11 Middle Curved Plate
12 Concave Heights
13 Heat Spreader (Heat Sink)
14 Resin
15 Metal Ring
16 Projection
17 Flat Spring
18 Right Thermal-Conductivity Adhesives

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
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[Drawing 2] It is the sectional view of the package shown in order of the process for explaining the gestalt of 1 implementation of the manufacture approach of the semiconductor device of this invention.
[Drawing 3] It is the sectional view of the package in which the gestalt of operation of the 2nd of the semiconductor device of this invention is shown.
[Drawing 4] It is the sectional view of the package in which the gestalt of operation of the 3rd of the semiconductor device of this invention is shown.
[Drawing 5] It is the sectional view of the package in which the gestalt of operation of the 4th of the semiconductor device of this invention is shown.
[Drawing 6] It is the sectional view of a semiconductor package showing a conventional example.
[Drawing 7] It is the sectional view of a semiconductor package showing other conventional examples.
[Drawing 8] It is the sectional view of a semiconductor package showing another conventional example again.
[Description of Notations]
1 Substrate
2 Internal Wiring
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12 Concave Heights
13 Heat Spreader (Heat Sink)
14 Resin
15 Metal Ring
16 Projection
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18 Right Thermal-Conductivity Adhesives

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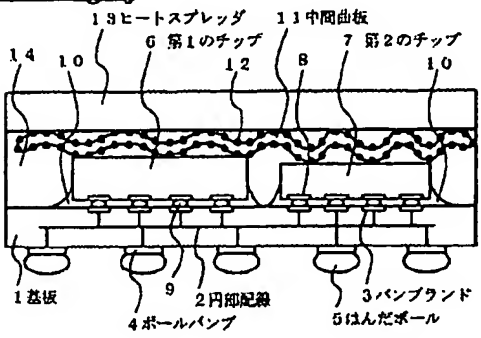
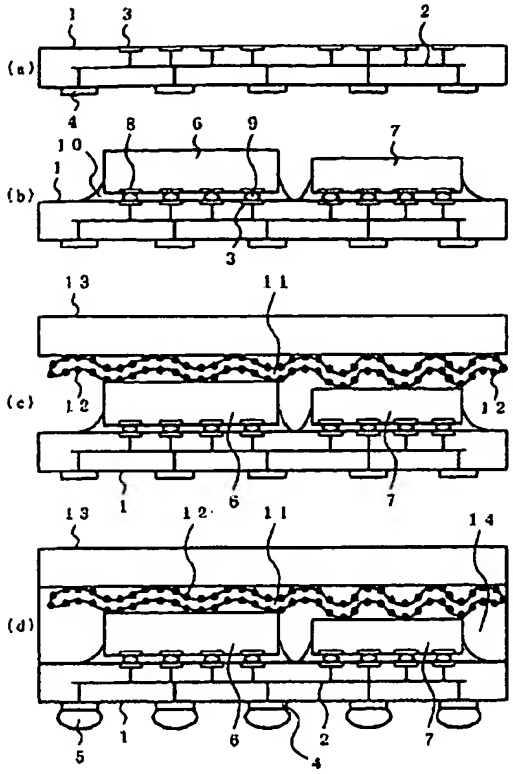
DRAWINGS

[Drawing 1]

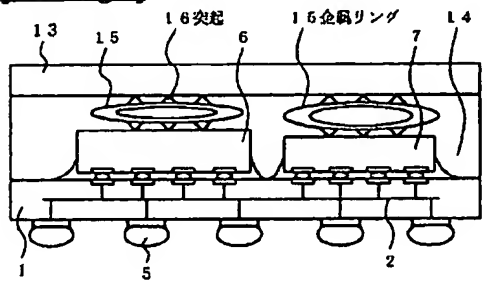


8：パッド　　10：アンダフィル樹脂
9：金バンプ　　12：凹凸部
14：樹脂

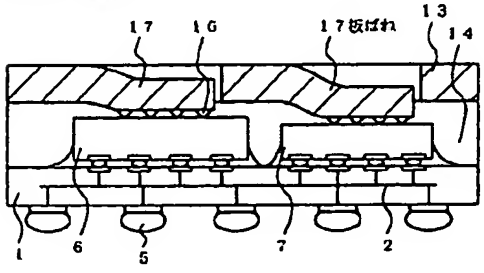
[Drawing 2]



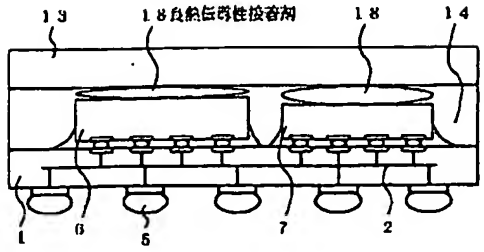
[Drawing 3]



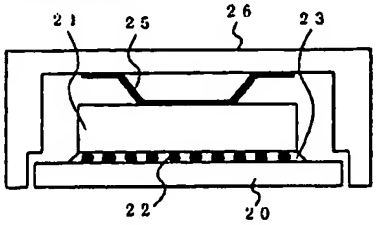
[Drawing 4]



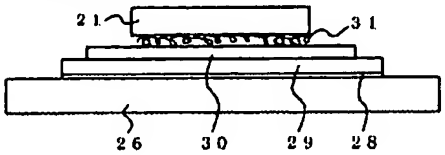
[Drawing 5]



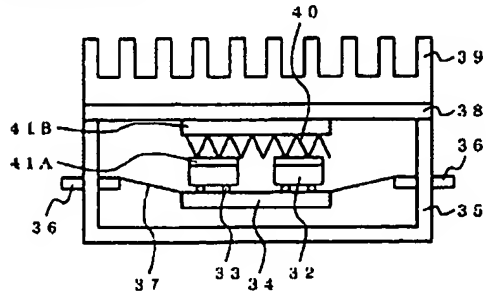
[Drawing 6]



[Drawing 7]



[Drawing 8]



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